

Natural Resource Management for Sustainable Development

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INTRODUCTION

Mountains are also global centres of ecosystem complexity (biodiversity defined ecologically in its broadest sense sub-specific, species, ecosystem and landscape levels). Their steep slopes and sharp gradients render their ecosystems very fragile. In the developing tropics, these fragile mountain ecosystems are being constantly exploited for the rich natural resources they contain - resources such as timber, the biodiversity that they harbour, medicinal plants from the wild, mineral resources, water resources for hydro-electric power generation, etc. Apart from the dependence of mountain societies themselves on the forests around them, to meet a variety of their daily needs, such as food, fodder, fuel wood, medicine and other non-timber forest products (Ramakrishnan *et al.* 2002),



This knowledge base operates at varied levels of ecosystem complexity – sub-specific/species levels going right up to the landscape level complexity.

This paper analyses the special features of this socio-ecological system complexity and considers various possibilities for sustainable management of natural resources, with concerns for sustainable livelihood of mountain communities.

Principles of Natural Resource Management (NRM)

NRM includes eight principles of legitimacy, transparency, accountability, involvement, fairness, integration, capability, and adaptability -these features provide normative guidance for the establishment of multilevel NRM governance.

- The principles of NRM include the following practical methods:
- Learn from experiences.
- Establish and maintain an efficient project management process.
- Ensure local participation in decision-making.
- Build the project in the local context.
- Determine communication and knowledge-sharing strategy
- Develop a risk strategy
- Conduct regular monitoring and evaluation
- Consider reusing and recycling for future uses.
- Follow the principle of bio-climatic and adaptable designs.

The climate warming trend is explicit and now well documented in many studies conducted by researchers. Over the past few decades, the Earth has experienced rapid warming with record high temperatures occurring in the last decade alone. Human activities are the primary drivers of climate change as they contribute to more than 95 percent of the rapid temperature rise especially due to the burning of fossil fuels, deforestation and land-use changes that emit greenhouse gases. The impact of global warming is evident across the world and is projected to become even more disruptive in the future. In addition to mitigation action to reduce the extent of warming, it is imperative to adapt to the climate change that already exists. Adaptation, however, has become more difficult due to the uncertainties caused by the effects of climate change; therefore, it requires further intervention on many levels.



Our planet has already committed to climate change and will experience its associated impacts; thus, mitigation along with adaptation strategies cannot be mutually exclusive. Yet, international and national policies to tackle climate change have focused more on mitigation than adaptation. On the other hand, indigenous communities have been continuously adapting to environmental stresses for millennia, including more recent cascading impacts of climate change. Indigenous communities have developed a wealth of information in the form of their traditional ecological knowledge (TEK), based on their observations of the obvious linkages between changing climatic conditions and biodiversity.



Natural resources are utilized by humans to fulfil their daily needs, both directly and indirectly through management process. Meeting the human needs through the natural resources utilization and management is indeed a fundamental thing, however, each

individual in order to manage natural resources must also pay attention to the common welfare (the public interests) and maintain the surrounding environment because in the

environment has a life-value that is the right of all people.



Suggested Gender-Related Indicators for Agriculture and Natural Resource Management Projects-

Sub-sector Indicators	Input Indicators	Output Indicators	Impact Indicators
<ul style="list-style-type: none"> ◆Changes in the role of men and women in agriculture in project area. ◆Increase in number of female headed households, women as land-owners, etc. ◆Increase in awareness about conservation-oriented practices among men and women. 	<ul style="list-style-type: none"> ◆Incorporation of women farmers/ landless farmers in project activities ◆ Women’s level of participation in extension programs’ planning and implementation ◆ Mass media materials on technology and practices available ◆ Support for technology adoption –research, training, inputs ◆ Amount of funding for gender specific activities. 	<ul style="list-style-type: none"> ◆Improvement in access to resources by men and women farmers ◆ % of men and women adopting sustainable practices ◆ Increase in number of women participating in field training and farmers’ groups activities ◆ Increase in productivity of degraded lands. 	<ul style="list-style-type: none"> ◆Improvement in land management practices, reduction in land resource degradation ◆Improvement in productivity of degraded lands and ◆Improvement in women’s income ◆Women’s empowerment and overall well being – nutrition and health.

Advantages

- Greater biodiversity in ecosystems, species, and individuals leads to greater stability. For example, species with high genetic diversity and many populations that are adapted to a wide variety of conditions are more likely to be able to weather disturbances, disease, and climate change.
- Preserving genetic diversity ensures the continuing existence of a wide-range of crops that may be able to withstand disease, and potentially useful biochemicals such as those used in healthcare.
- It also means availability of species for pollination and pest control.

Ecosystems are essential to our well-being and prosperity as they provide us with food, clean air and fresh water. Ecosystems also represent an exceptional source of outdoor recreation opportunities.

- Ecosystem Services are the direct and indirect contributions ecosystems (known as natural capital) provide for human wellbeing and quality of life. This can be in a practical sense, providing food and water and regulating the climate, as well as cultural aspects such as reducing stress and anxiety.
- Healthy terrestrial ecosystems are vital for human welfare and survival,

as they provide us with essential products and benefits. Over 90% of our food comes from terrestrial ecosystems, which also provide energy, building materials, clothes, medicines, fresh and clean water, and clean air.

Disadvantages

- And because no-till farming provides good environment for pathogens, insects and weeds, it can lead farmers to a more intensive use of chemicals for pest control. Other disadvantages of no-till include underground rot, low soil temperatures and high moisture.
- Biodiversity loss can have significant direct human health impacts if ecosystem services are no longer adequate to meet social needs. Indirectly, changes in ecosystem services affect livelihoods, income, local migration and, on occasion, may even cause or exacerbate political conflict.
- The more number of animals and plants increases the population and this can cause more consumption of resources and extinction of resources. Excess of biodiversity can cause loss of life by one animal attack over another animal or human.
- Declining biodiversity lowers an ecosystem's productivity (the amount of food energy that is converted into the

biomass) and lowers the quality of the ecosystem's services (which often include maintaining the soil, purifying water that runs through it, and supplying food and shade, etc.)

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